REMARKS

In response to the Official Action mailed April 19, 2004, Applicants respectfully request reconsideration. In this Response, no claims have been added, canceled, or amended so that claims 1-8 remain pending. No new matter has been added.

Claims 4-6 are allowed. A comma is added to claim 4. This amendment is not substantive and does not change the allowability of claims 4-6.

Non-substantive amendments are made to claims 1, 3, 7, and 8. The changes to claims 1, 3, and 7 make the language of those apparatus claims agree more exactly. No new issue can be raised because the language, as amended, already appeared in the claims. The indefinite article beginning claim 8 is changed to the definite article since that claim is a dependent claim.

Claims 1-3 and 7-8 are rejected as unpatentable over Shofner et al. (US Patent 5,533,145, hereinafter Shofner) in view of Borchers et al. (US Patent 5,753,931, hereinafter Borchers). That rejection is respectfully traversed. Applicants noted in the Amendment filed January 22, 2004, that Shofner was not cited on the PTO-892 form and therefore not of record in this prosecution. Applicants requested a supplemental PTO-892 form, which was not provided with the present Official Action. A supplemental PTO-892 form making Shofner of record is again requested.

Independent claims 1, 3, and 7 are all directed to a method and an apparatus for objectively determining the grade of a fabric based on images of the fabric captured when the fabric is illuminated from at least two different directions. Claim 1 recites a step of analyzing the images to derive surface normal gradients of the fabric. Apparatus claims 3 and 7 include a computer programmed to derive the surface normal gradients of the fabric from the captured images. The combination of Shofner and Borchers simply fails to teach or suggest these limitations.

As discussed in the Amendment filed January 22, 2004, it is commonly known in mathematics that a surface normal is a three-dimensional vector that is perpendicular to a surface at a given point on the surface. The direction and magnitude of the surface normal is a function of the location of normal on the surface. The surface normal gradient expresses the change of the surface normals as a function of position, and, as with any gradient, is a vector determined by partial derivatives of the distribution of surface normals as a function of location. In the present invention, the surface normal gradient is obtained using the calculated irradiance of a surface element (see pages 7-9 of the patent application).

The Official Action contends that the derivation of a surface normal gradient is taught by Shofner at column 14, lines 16-32. However, this contention is erroneous.

Shofner is directed to a method and apparatus for identifying irregularities, such as knots due to irregular growth of cotton fibers caused in the course of ginning or clusters of wool in webs of fabric. The presence of these irregularities is detected by considering images of light formed by light that is both reflected from a web of the fibers, i.e., fabric sample, and light that is transmitted through the fabric sample. The passages cited at columns 14-16 are part of the disclosure of Shofner directed to identifying these "entities" based on the images formed. For each such entity, i.e., feature, the boundaries of the feature are determined. Shofner, in passing, refers to three techniques for determining the boundaries of particular features, namely tracing techniques, high pass filtering, and derivative calculations. As is well know to those of fundamental skill in elementary calculus, a derivative usually means the result of differentiating a function, in this instance, presumably a rate of change at the edge of a feature identified in the process and apparatus described by Shofner. This mathematical process and the description in Shofner has nothing to do with the surface normal gradient or the determination of a surface normal gradient as in the method of claim 1 and as in the programmed computers of claims 3 and 7.

As already noted, the surface normal, which varies with location on the surface of the fabric sample, is a vector quantity. There is no vector quantity associated with any of the three methods alluded to in the cited passage of Shofner for determining the boundaries of a feature. The location of the boundary is a scalar value. In fact, the boundary in Shofner is a two dimensional quantity unlike the three dimensional information provided in the invention from the gradient of the surface normals to determine the grade of a fabric.

No reliance was placed upon Borchers as disclosing or suggesting the final limitation of each of the three independent claims, 1, 3, and 7. The image processing described by Borchers has no relationship to determining any surface normals, much less gradients of those surface normals.

Separate attention is given in the Office Action at page 5 to the final limitation of claim 3, an independent apparatus claim. According to that first paragraph at page 5 of the Office Action, Figure 10 and column 9, lines 31-35, apparently of Shofner, describe a computer program to derive values of P and Q as summations of surface normal gradients for a plurality of points distributed across the surface of fabric. This assertion is without foundation in Shofner. The passage of Shofner cited describes how a digital camera employing a CCD array is able to form eight images free of any overlap between the images using a diffraction grating. No computer is described, either explicitly or implicitly, in the

cited passage, much less a computer programmed to manipulate and mathematically calculate surface normal gradients to produce fabric quality information. This separate rejection with regard to claim 3 cannot properly be maintained. If the examiner intended to direct attention to a different part of either Borchers or Shofner in this rejection, then Applicants respectfully request a new Office Action accurately identifying the portions relied upon to supply programmed computer of not only claim 3 but also of claim 7. Applicants note the Office Action does not cite, with regard to claim 7, any part of Borchers or Shofner with regard to a programmed computer.

In summary, neither Shofner nor Borchers mentions deriving any kind of gradient at all. They do not even include the word "gradient" anywhere in their texts. Thus, it is impossible for the combination of Shofner and Borchers to teach or suggest all of the limitations of independent claims 1, 3, and 7. Accordingly, *prima facie* obviousness has not been established, and the rejection should be withdrawn.

The remaining claims, dependent claims 2 and 8, describe illuminating the fabric with four parallel light beams directed onto the fabric surface from four different directions and apparatus for producing that same four direction illumination. The combination of Shofner and Borchers fails to teach or suggest shining parallel light beams onto the surface of the fabric from four different directions. The Official Action concedes that Shofner does not teach this limitation, but asserts that Borchers:

> "teaches Fig. 2, [sic] two lasers 105a and 105b are used to project a plurality of parallel planes of laser light through a transparent plate onto a surface of object [sic] of light planes, and two cameras 104a and 104b respectively are couple to frame grabber as shown in Fig. 1, each laser and corresponding optics elements may generate parallel lines with close or overlapping images on the transparent plate."

This alleged teaching is silent regarding projecting light beams from four different directions, and thus is irrelevant to the invention defined by claims 2 and 8. The Official Action continues:

> "Therefore it would have been obvious to one having ordinary skill in the art at the time of [sic] the invention was made, to modify Shofner apparatus [sic] according to the teaching of Borchers because it provides a plurality of digital data representations corresponding to the plurality of laser line onto an object surface to determining [sic] a shape of the object based on the curvature of the reflected laser lines, which can easily be

implemented in an image device such as digital still or photometric stereo technique."

In this assertion, the Official Action fails to elucidate how Borchers can be used to modify Shofner to include projecting light beams from four different directions. The Official Action does not even mention projecting light beams from four different directions. In fact, it is impossible for Borchers to supply this teaching, since it discloses only two lasers 105a and 105b, and two lasers alone cannot supply light from four different directions (see Figure 2 of Borchers). Clearly, the combination fails to teach or suggest projecting light from four different directions. Accordingly, the rejection is clearly erroneous and should be withdrawn.

Reconsideration, entry of the Amendment, withdrawal of the rejections, and allowance of all pending claims are earnestly solicited. Since the Amendment merely improves the form of the claims, without raising any new issues, if the rejection is maintained, entry of the Amendment to place the claims in better form for appeal is proper and respectfully requested.

Respectfully submitted,

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